UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/587,223	07/24/2006	Hisashi Minemoto	10873.1906USWO	6668

53148 7590 09/11/2007

HAMRE, SCHUMANN, MUELLER & LARSON P.C.
P.O. BOX 2902-0902
MINNEAPOLIS, MN 55402

EXAMINER	
CHAET, MARISSA W	

ART UNIT	PAPER NUMBER
1722	

MAIL DATE	DELIVERY MODE
09/11/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/587,223	MINEMOTO ET AL.	
	Examiner	Art Unit	
	Marissa W. Chaet	1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-63* is/are pending in the application.

4a) Of the above claim(s) *39-63* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12,14-16,22,23,25-33 and 35-38* is/are rejected.

7)☒ Claim(s) *13,17-21, 24 and 34* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *24 July 2006* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *7/24/06*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

Restriction is required under 35 U.S.C. 121 and 372.

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1.

In accordance with 37 CFR 1.499, applicant is required, in reply to this action, to elect a single invention to which the claims must be restricted.

Group I, claims 1-38, are drawn to a crystal manufacturing apparatus.

Group II, claims 39-63, are drawn to a crystal manufacturing method.

The inventions listed as Groups I and II do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons. The crystal manufacturing apparatus is capable of growing GaAs crystals.

During a telephone conversation with Douglas Mueller on August 21, 2007, a provisional election was made with traverse to prosecute the invention of a crystal manufacturing apparatus, claims 1-38. Affirmation of this election must be made by applicant in replying to this Office action. Claims 39-63 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim

remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Drawings

The drawings are objected to because Figure 17 should be labeled as prior art. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

Claims 1, 7, and 28 is objected to because of the following informalities:

1. Regarding claim 1, on line 15, language should be "gas containing nitrogen introduced through . . ."

2. Claims 7 and 22 do not further limit the structure of the apparatus claim.

3. Regarding claim 28, on line 2, one "at" should be deleted. Appropriate correction is required.

Claim Rejections - 35 USC § 102(e)

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

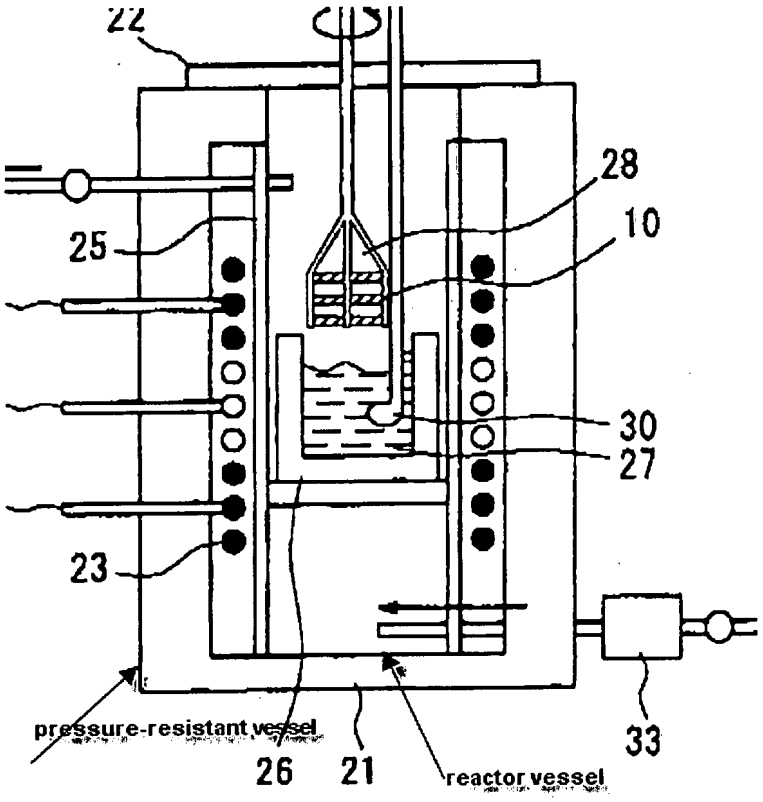
The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

1. Claims 1-3, 23, 35-37 are rejected under 35 U.S.C. 102(e) as being anticipated by Kitaoka et al. (US 7,221,037).

2. Regarding claim 1, Kitaoka discloses a crystal manufacturing apparatus that grows GaN crystals using a crystal raw material solution containing Ga, nitrogen, and Na, the GaN crystals being grown in an atmosphere of nitrogen gas by applying heat and pressure thereto so as to allow the nitrogen and the Ga in the crystal raw material solution to react with each other, the apparatus comprising: a reactor vessel in which

the crystal raw material solution can be placed; and a gas supply device (31) for introducing nitrogen into the reactor vessel, wherein the reactor vessel and the gas supplying device are coupled, the reactor vessel has a gas inlet and gas outlet; and nitrogen introduced through the gas inlet that is not used for the reaction is exhausted through the gas outlet. See Fig. 4; col. 7, line 37 – col. 8, line 36.

3. Regarding claim 2, Kitaoka discloses a pressure-resistant vessel (21); and a heater (23) that applies heat to the reactor vessel, wherein the reactor vessel is stored in the pressure-resistant vessel (21), and the reactor vessel and the gas supplying device (31) are coupled via the gas inlet. See Fig. 4; col. 7, line 37 – col. 8, line 36.



4. Regarding claim 3, Kitaoka discloses nitrogen supplied from the gas supplying device (31) firstly passing through the gas inlet and is introduced into the reactor vessel,

and then can be exhausted through the gas outlet to outside of the pressure-resistant vessel. See Fig. 4; col. 7, line 37 – col. 8, line 36.

5. Regarding claim 23, Kitaoka discloses a gas flow rate regulator (32); and a pressure regulator (bottom valve), wherein the nitrogen is introduced from the gas supplying device (31) to the reactor vessel via the gas flow rate regulator, the pressure-resistant vessel has a gas outlet, to which the pressure regulator is connected, and the gas flow rate regulator and the pressure regulator allow pressures in the reactor vessel and the pressure-resistant vessel to be controlled. See Fig. 4; col. 7, line 37 – col. 8, line 36.

6. Regarding claim 35, Kitaoka discloses an induction-type heater (23). See Fig. 4.

7. Regarding claim 36, Kitakoa discloses crystals that are $Al_xGa_yIn_{1-x-y}N$, where $0<=x<=1$, $0<=y<=1$, $0<=x+y<=1$. See col. 2, lines 20-57.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. **Claims 4 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitaoka et al. (US 7,221,037) in view of Porowski et al. (US 5,637,531).** Kitaoka does not disclose a gas inlet and outlet adjacent to one another. However, Porowski discloses a gas inlet (22) and gas outlet (24) that are adjacent to one another. See Fig.

1. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to change the locations of the gas inlet and outlet to be adjacent to one another, such as in Porowski, for design purposes. See *In re Japikse*, 86 USPQ 70; *In re Gazda*, 104 USPQ 400. Furthermore, it would have been obvious to one of ordinary skill at the time of the invention to include a plurality of gas outlets so that the gas can be exhausted at a faster rate.

9. **Claim 6-8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitaoka et al. (US 7,221,037) in view of Schowalter (US 6,770,135).** Kitakoa does not disclose a baffle plate. However, Schowalter discloses baffle plates (4) with a through hole formed therein, wherein the baffle plate is placed in the reactor vessel (3) closer to a liquid surface of the crystal raw material solution (11) than the gas inlet (18) and gas outlet (16). See Fig. 2; col. 10, line 60 – col. 11, line 5. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kitaoka to include baffle plates, such as suggested in Schowalter, to help control the temperature gradient along the crucible axis. Furthermore, it would have been obvious to one of ordinary skill in the art at the time of the invention to change the shape of the hole to a taper shape. See *In re Dailey et al.*, 149 USPQ 47; *Eskimo Pie Corp. v. Levous et al.*, 3 USPQ 23.

10. **Claims 9-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitaoka et al. (US 7,221,037) in view of Motakef et al. (US 7,052,546).**

Regarding claims 9 and 12, Kitaoka discloses a gas exhaustion tube that is placed outside of the reactor vessel via the gas outlet. See Fig. 4.

Regarding claim 10, Kitaoka discloses a gas outlet formed at a side wall of the reactor vessel. See Fig. 4.

However, Kiaoka does not disclose a cooling tube. Motakef discloses a cooling tube (22) that is placed close with the perimeter of the gas outlets (28. 30). See Fig. 1; col. 6, line 60 – col. 7, line 61. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kitaoka to include a cooling tube, such as suggested in Motakef, to cause reactive gases to be at a temperature such that gases do not undergo any substantial amount of reactions before entering the reaction chamber.

Regarding claim 11, it would have been obvious to one of ordinary skill in the art at the time of the invention to change the location of the gas outlet to the top wall face of the reactor vessel. See *In re Japikse*, 86 USPQ 70; *In re Gazda*, 104 USPQ 400.

Regarding claim 12, it would have been obvious to one of ordinary skill in the art at the time of the invention to change the shape of the gas exhaustion tube to a funnel shape. See *In re Dailey et al.*, 149 USPQ 47; *Eskimo Pie Corp. v. Levous et al.*, 3 USPQ 23.

11. **Claims 14-15 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitaoka et al. (US 7,221,037).**

12. Regarding claims 14-15, Kitaoka discloses valves placed at the gas inlet and gas outlet. See Fig. 4. However, Kitaoka does not disclose a detachable reactor vessel. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a detachable reactor vessel for cleaning purposes.

13. Regarding claim 22, Kitaoka discloses nitrogen released into the reactor vessel. See Fig. 4. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention that the nitrogen controls the pressure of the reactor vessel and the pressure-resistant vessel, because the reactor vessel is placed in the pressure-resistant vessel.

14. **Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitaoka et al. (US 7,221,037) in view of Liu (US 2005/0011436)**. Kitaoka does not disclose the thickness of the gas inlet or outlet. However, Liu discloses a gas inlet that has a diameter between 0.25 inches (6.35 mm) and 1.5 inches (38.1 mm). See para. 92. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kitaoka to include the thickness of the gas inlet, such as suggested by Liu, to control the rate of the gas. Furthermore, it would have been obvious to one of ordinary skill in the art at the time of the invention to make the diameter of the gas outlet the same as the gas inlet to control the rate of gas exhausted from the vessel.

15. **Claims 25-27 and 29-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitaoka et al. (US 7,221,037) in view of Suscavage et al. (US 6,676,752)**.

16. Regarding claim 27, Kitaoka discloses a gas flow rate regulator (32) for the nitrogen gas introduced from a gas supplying device (31) to the reactor vessel via the gas flow rate regulator.

However, Kitaoka does not disclose two gas supplies. Suscavage discloses a first and second gas supplying device, the first gas supply of hydrogen gas (18)

connected to the gas inlet of the reactor vessel (10), the gas outlet (11) of the reactor vessel directly communicating with the pressure-resistant vessel (16) with outlet (22), the second gas supply of an inert gas (17) connected to the gas inlet of the pressure-resistant vessel (16). See Fig. 1; col. 3, lines 25-65. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kitaoka to include two gas supplying devices with two separate flow rate regulators and two separate pressure regulators, such as suggested by Suscavage, so that the first gas directly reacts with the crystal raw material solution and the second gas does not directly react with the solution. Furthermore, it would have been obvious to one of ordinary skill in the art at the time of the invention that the pressure would be controlled separately if there are two separate gas supplying devices.

Regarding claims 29 and 30, it would have been obvious to one of ordinary skill in the art at the time of the invention to use gases with a high purity to produce crystals without impurities. It is further obvious that the two different gases used will have two different purities.

Regarding claim 33, it would have been obvious to one of ordinary skill in the art of the time of the invention to introduce air into the pressure-resistant vessel to help remove contaminants.

17. **Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitaoka et al. (US 7,221,037) in view of Das et al. (US 7,022,378).** Kitaoka does not disclose the flow velocity of the nitrogen. However, Das discloses the flow rate of ammonia from about 1 cm/sec to about 100 cm/sec. See col. 3, lines 33-40. Thus, it

would have been obvious to one of ordinary skill in the art at the time of the invention to include the gas flow rate, such as suggested by Das, as a suitable velocity for the particular equipment used in the reaction.

18. **Claim 38 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitaoka et al. (US 7,221,037) in view of Suscavage et al. (US 6,676,752) and in further view of Das et al. (US 7,022,378).** Kitaoka discloses nitrogen gas or ammonia gas. Suscavage discloses ammonia gas and hydrogen or an inert gas. However, neither reference discloses a gas containing nitrogen gas further comprising an inert gas or hydrogen gas. Das discloses a combination of an inert gas, hydrogen, and/or nitrogen gas. See col. 7, lines 60-65. Thus, it would have been obvious to one of ordinary skill in the art at the time of the invention to carry out post nitridration annealing.

Allowable Subject Matter

Claims 13, 17-21, 24, and 34 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter.

Regarding claim 13, there is no prior art of record that discloses a drops guide wherein one end of the drops guide is placed at the gas exhaustion tube, and the other end is placed in the crystal raw material solution, and an internal structure of the gas

exhaustion tube includes funnel structures stacked as a multistage, win which adjacent funnel structures have centers displaced from each other.

Regarding claims 17-21, Kitaoka discloses a gas inlet and gas outlet of certain length. However, there is no reason to provide an extra length portion to the gas inlet or outlet that is at least 5 mm of coil-form or waveform without hindsight.

Regarding claims 24 and 34, there is no prior art of record that discloses a recovery device that a connected to a pressure regulator, where the recovery device allows recovery of an alkali metal evaporating from the crystal raw material solution.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marissa W. Chaet whose telephone number is 571-272-8094. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra N. Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MWC
August 29, 2007

/Robert Kunemund/
Robert Kunemund
Primary Examiner
AU 1722